TI Report No. 03-65-126

FIRST QUARTERLY REPORT

for

QUALIFICATION TESTING STUDY
AND
TEST PROGRAM OF INTEGRATED CIRCUITS

(29 June 1965 — 30 September 1965

Contract No.: NAS 8-20241

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SECTION I

INTRODUCTION

This report is a summary of work completed to date in the qualification testing study and test program of integrated circuits required by Contract No. NAS 8-20241. The objective of this program is to conduct a study and test program involving a minimum of 52 integrated circuits to determine the effectiveness of specified screening techniques. The program consists of three major phases:

1) Procurement of devices.

2) Qualification and screening tests.

3) Operation life tests.

Phases 1 and 2 have been completed and Phase 3 is in process.

SECTION II

DISCUSSION OF WORK, PROGRESS AND RESULTS TO DATE

A. GENERAL

Devices to be tested in this program were obtained in early October. A delay from the original schedule occurred due to the revision of the manufacturing operation from a gold-aluminum interconnection system to a gold-gold system. This revision took place early in September, and devices were available in early October.

B. SCREENING TESTS

The devices were subjected to screening tests which consisted of:

1) Temperature cycling.
2) High-temperature bake.
3) Constant acceleration.
4) Electrical tests.
5) Operating burn-in.
6) Electrical test.
7) X-ray.
8) Fine leak detection.
9) Gross leak detection.

The yield of the SMN 513 devices was low due to poor emitter-follower readings that were obtained at the pre-burn-in electrical test; additional devices were obtained and processed. A "used-passed" record of the screening tests is shown in Table 1.

C. ELECTRICAL AND QUALIFICATION TESTS

Upon completion of the screening tests, the devices were electrically tested to the performance requirements and variables data was taken. The devices that passed these tests were divided into four groups and the qualification tests were begun (see Fig. 1).

1. Group B

a. Subgroup 1

Five pieces (5 SMN 511) were subjected to:

1) Dimensional check.

2) Solderability test.

3) Solvent resistance test.

One device failed the post-electrical test and was submitted for failure analysis.

b. Subgroup 2

Twenty pieces (10 SMN 511, 10 SMN 515) were subjected to:

1) Lead fatigue.

2) Thermal shock.

3) Radiflo.

4) Gross leak detection.

There were no failures in this group.

2. Group C

Twenty-five pieces (10 SMN 513, 10 SMN 514, 5 SMN 515) were subjected to:

1) Mechanical shock.

2) Centrifuge.

3) Variable frequency vibration testing.

One device failed the post-electrical test and was submitted for failure analysis.

3. Group D

Seventy pieces (15 SMN 511, 20 SMN 513, 20 SMN 514, 15 SMN 515) were held to be subjected to 2000-hour operating life testing with the other groups.

4. Group R

Fifty-two pieces (13 SMN 511, 13 SMN 513, 13 SMN 514, 13 SMN 515) were held to be subjected to 2000-hour operating life testing with the other groups.

D. OPERATING LIFE TEST

After completing the testing of Group B and Group C, the passing devices were combined into Group E — forty-eight pieces (14 SMN 511, 9 SMN 513, 10 SMN 514, 15 SMN 515) and along with Group D and Group R were placed on the operating life test. This test was begun on 26 November 1965 and is expected to be completed by 1 March 1966 (see Fig. 2).

Table 1. Used-Passed Record of Screening Tests

Operation	SMN 511		SMN 513				SMN 514		SMN 515		Remarks
	Use	Pass	Use	Pass	Use	Pass	Use	Pass	Use	Pass	
Procurement of Devices	47 56		104		86		99		96		
High Temperature Storage 200°C-48 Hours	103	103	104	104	86	86	99	99	96	96	
Temperature Cycling, 10 cycles, -55°C to +150°C	103	103	104	104	86	86	99	99	96	96	
Centrifuge 20,000 g, Y_1 direction	103	103	104	104	86	86	99	99	96	96	
Electrical test (attributes) dc, +125°, -55°C; ac +25°C	103	73	104	15	86	76	99	68	96	82	
Burn-in (operating) 96 hours at +125°C	73	73	15	15	76	76	68	68	82	82	
Electrical test (attributes) dc +125°, -55°C; ac, +25°C	73	73	15	14	76	60	68	67	82	82	
Clip Out	73	73	14	14	60	60	67	67	82	76	
Serialize and Symbolize	73	73	14	14	60	60	67	67	76	76	
X-ray	73	61	14	12	50	43	67	56	76	64	
Fine Leak Test 1 x 10^{-8}cc/sec	61	56	12	12	43	43	56	55	64	62	
Gross Leak Test, Ethylene Glycol at +150°C	54	53	12	12	43	43	55	54	61	61	
Visual Inspection	53	53	12	12	43	43	54	54	61	61	

Table 1. Used-Passed Record of Screening Tests (Continued)

Operation	SMN 511		SMN 513				SMN 514		SMN 515		Remarks
	Use	Pass	Use	Pass	Use	Pass	Use	Pass	Use	Pass	
Electrical test (variables) dc, +125°, -65°C; ac, +25°C	53		12		43		54		61		
Qualification Test Group											
Subgroup B_1	5	4									1 pc to F/A
Subgroup B_2	10	10							10	10	
Group C			10	9			10	10	5	5	1 pc to F/A
Group D	15		2		18		20		15		Start 11/26/65
Group E	14		9				10		15		Start 11/26/65
Group R	13				13		13		13		Start 11/26/65

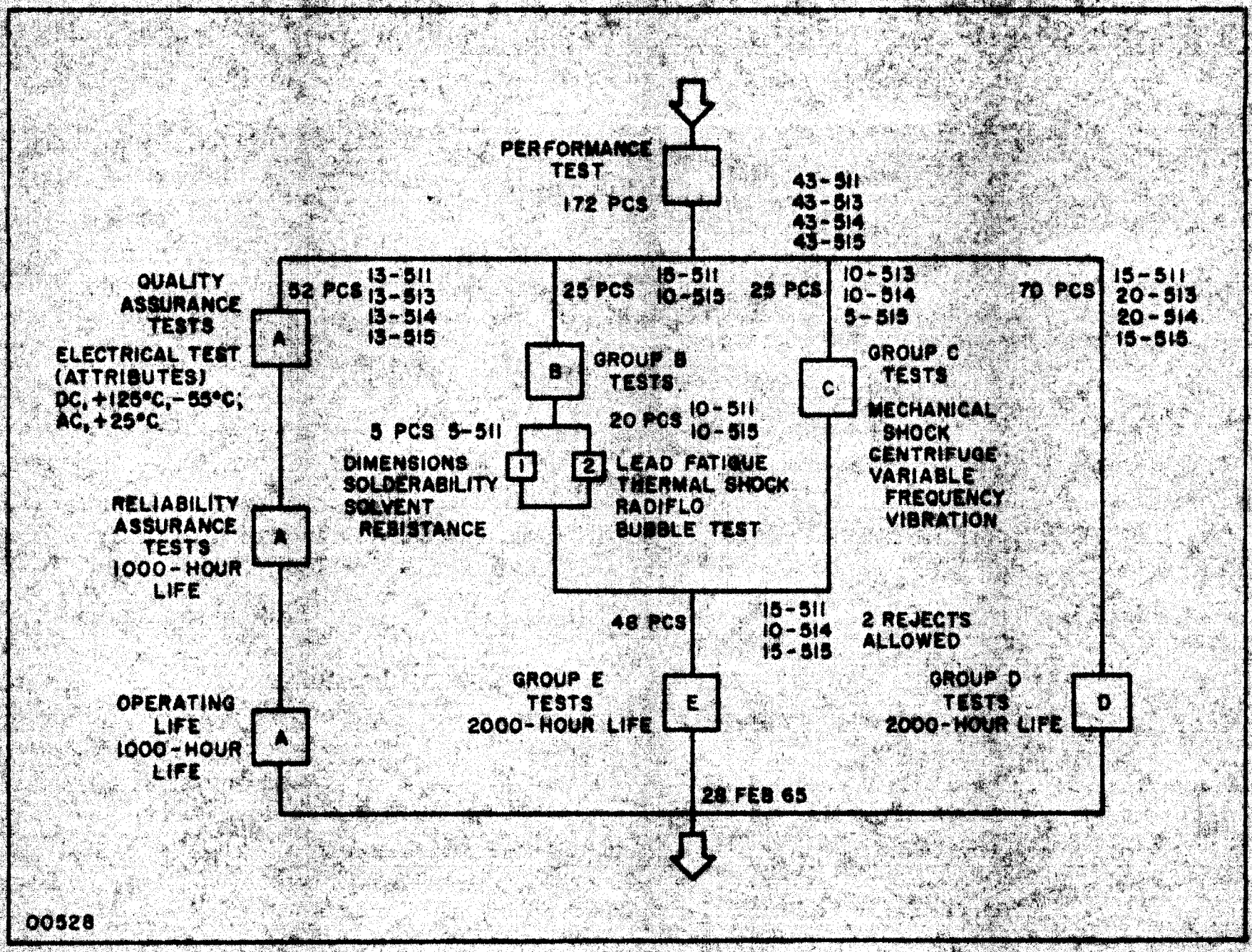

Fig. 1. Performance and Qualification Testing Program

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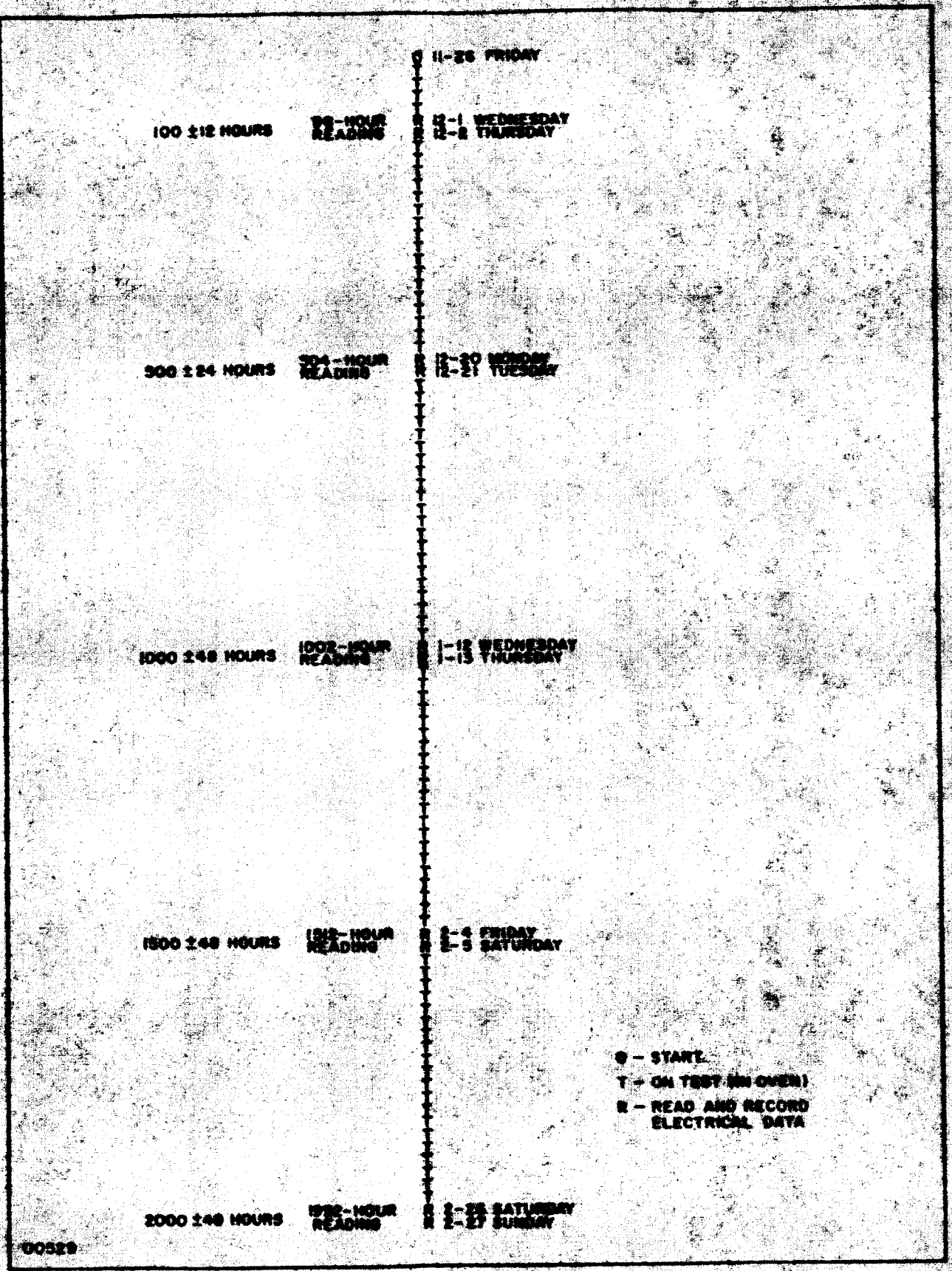

Fig. 2. Operating Life Test